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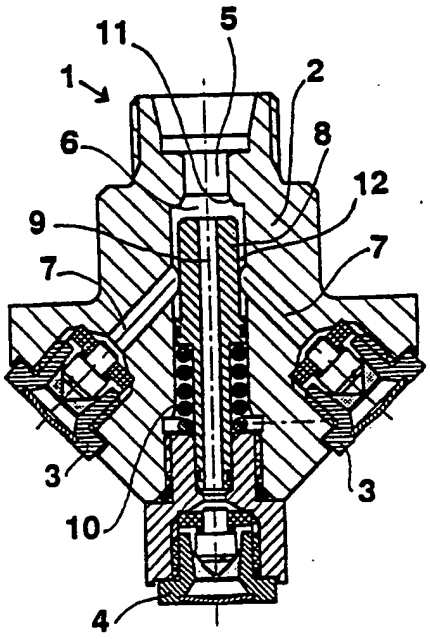
(54) Title: FIRE FIGHTING EQUIPMENT

(57) Abstract

The present invention relates to a fire fighting equipment, comprising at least one spray head (1) with a number of nozzles (3) directed obliquely sideways. The nozzles (3) are arranged so close to each other that the fog formation areas of the individual nozzles intensify the fog flows and provide a suction to cause the fog formation areas to be compressed into a continuous directional fog spray.



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Fire fighting equipment

The present invention relates to a fire fighting equipment, comprising at least one spray head with a number of nozzles directed obliquely sideways.

The object of the invention is to provide a new fire fighting equipment with a strong penetrating power and a low consumption of fire extinguishing liquid.

The fire fighting equipment according to the invention is mainly characterized in

that the nozzles are arranged to operate under high pressure for spraying fog-like extinguishing liquid and

that the nozzles are arranged so close to each other that the fog formation areas of the individual nozzles intensify the fog flows and provide a suction causing the fog formation areas to be compressed into a continuous directional fog spray.

By means of such a directional fog spray, it is possible to extinguish fires considered extremely difficult to extinguish, a fire in a friteuse, for instance, in a short time and with a small amount of water.

Getting the fog spray concentrated as desired depends on several parameters, such as individual spread angles and mutual main directions of each nozzle as well as on the drop size; a large individual spread angle facilitates contact with the fog screen of adjacent nozzles and thus the total concentration by means of suction from outside. The resulting fog flow pattern has a resemblance to a sponge with a relatively round head.

The concentration becomes stronger with increasing operating pressure; the fog sprays turn rap-

idly toward each other and are accompanied thereafter. The concentration effect can be secured by means of a fifth nozzle directed centrally straight downwards.

In order to secure necessary suction from outside and above, if the spray head is mounted on a ceiling, a certain space of e.g. a couple of centimetres shall preferably exist between the ceiling and the openings of the nozzles. Flue gases generated by the fire will be sucked into the extinguishing fog and will thereby be cooled and at least partially purified.

With the concentration of the different fog sprays, the drops therein will collide with one another and split into smaller ones, which improves the extinction effect.

The initial size of the fog drops shall not be too big, because the fog sprays of the different nozzles then risk losing the mutual contact necessary for the common fog spray.

In each case the drop size as well as the other parameters at different operating pressures can be determined by testing.

Each nozzle preferably comprises a nozzle socket fastened inside a housing of the spray head, in which socket are positioned a mouthpiece and, bearing against it, a whirler, which together with the mouthpiece defines a whirl chamber, the whirler being supported in the housing in such a way that the whirler is set in rotation by the liquid pressure.

The contact surface of the whirler against the mouthpiece preferably comprises at least one oblique groove for leading liquid into the whirl chamber.

The spray head is preferably intended to be operated by a high liquid pressure of e.g. 100 bar or

more to provide the so-called fog formation. The high operating pressure sets the whirler in high-speed rotation, due to which the small outflowing drops are brought into strong turbulence, which results in increased extinction effect thanks to the high speed of the drops.

The whirler can preferably be supported in the housing via a filter and an elastic sealing means positioned between the whirler and the filter.

A nozzle formed in this way can be manufactured in a length of about 10 to 12 mm, while conventional nozzles have a length of about 35 to 40 mm. A spray head of metal provided with e.g. four nozzles according to the invention has a weight of about 600 g, while a corresponding spray head provided with conventional nozzles weighs about 3 to 4 kg.

A preferred embodiment of the fire fighting equipment of the invention is characterized in

that the spray head comprises a nozzle positioned centrally with respect to said nozzles directed obliquely sideways,

that the connecting channel from the inlet of the spray head to the centrally positioned nozzle, from which channel branchings extend to the nozzles directed obliquely sideways, comprises a spindle having a connection to the centrally positioned nozzle,

that the spindle is arranged to be subjected to the effect of a force tending to press the spindle, against the liquid pressure of the inlet of the spray head, to close contact with the inlet, during which contact the connection between the inlet and said nozzles directed obliquely sideways is closed, while the connection via the spindle to the centrally positioned nozzle remains, and

that the operating liquid aggregate of the

spray head has a reducable operating pressure so

that the operating pressure at a first stage overcomes the counterforce of the spindle, extinguishing liquid being sprayed out through all nozzles, and at a second stage is overcome by the counterforce of the spindle, liquid being sprayed out only through the centrally positioned nozzle.

This embodiment can preferably be used for fighting against fire in engine rooms of ships and in spaces comparable to them.

According to the prevailing opinion, effective fire fighting within a fire zone in an engine room presupposes an amount of water up to about 500 to 600 litres per minute. To achieve this by means of a pump delivering water directly from a tank, a power of about 130 to 140 kW is required for the pump.

The invention also relates to the provision of a new installation capable of effective fire fighting by utilizing a low pump effect.

The installation is characterized in

that a liquid pump with a high operating pressure and with a volume capacity considerably lower than the amount of water required for extinguishing is arranged to charge a number of hydraulic accumulators connected in parallel in the rest state of the installation,

that these hydraulic accumulators are arranged to deliver extinguishing liquid to a seat of fire discovered, and

that a main line extending to the seat of fire is arranged to be closed after the hydraulic accumulators have been emptied, for a recharge of these accumulators and, if necessary, for a new delivery of extinguishing water.

For instance, five hydraulic accumulators con-

nected in parallel, 50 litres each with a charging pressure of about 200 bar and a discharged pressure at rest of about 50 bar, can be used. Such a set of accumulators is capable of delivering a sufficient amount of water quickly enough to extinguish a fire broken out.

The liquid pump of the installation can have a power as low as 15 kW and a volume capacity of about 35 litres per minute.

In the following, the invention will be described with reference to exemplifying embodiments shown schematically in the enclosed drawing.

Figure 1 shows an end view of a spray head.

Figure 2 shows a longitudinal section through the spray head according to Figure 1, the spray head being activated for fire extinguishing.

Figure 3 shows a longitudinal section through the spray head according to Figure 1, the spray head being activated for cooling.

Figure 4 shows a side sectional elevation of a preferred embodiment of a nozzle.

Figure 5 shows, like Figure 4, an alternative embodiment of a nozzle.

Figure 6 shows schematically an example of an installation in which the spray heads according to Figures 1 to 3 preferably can be used.

In the figures 1 to 3, the reference numeral 1 indicates generally a spray head. A housing or a body of the spray head 1 is indicated by 2 and four nozzles directed obliquely downwards to the side are indicated by 3.

A nozzle directed downward and positioned centrally with respect to the nozzles 3 is indicated by 4.

A liquid inlet of the spray head is indicated

by 5. The inlet 5 changes into an axial boring 6 a little expanded with respect to the inlet, from which boring borings 7 extend to the side nozzles 3. In the axial boring 6 is positioned a spindle 8 with a through axial boring 9 leading to the centrally positioned nozzle 4 usually directed downwards.

A spring 10 is arranged to press the end of the spindle 8 against a shoulder 11 formed in the inlet 5.

If the pressure acting on the end of the spindle 8 via the inlet 5 overcomes the force of the spring 10, the spindle 8 takes a position according to Figure 2. In this position, liquid can flow from the inlet 5 partially through the boring 9 of the spindle 8 to the centrally positioned nozzle 4 and partially via an annular space 12 between the spindle 8 and the wall of the boring 6 through the borings 7 extending from the boring 6 to the side nozzles 3.

If the force of the spring 10 overcomes the pressure counteracting via the inlet 5, the spindle 8 takes the position according to Figure 3. In this position, the end of the spindle 8 is in close contact with the shoulder 11 of the inlet 5; the connection to the side nozzles 3 is closed, while the connection to the centrally positioned nozzle 4 remains.

A spray head according to Figures 1 to 3 is especially suitable for being used for fire fighting in engine rooms of ships and spaces comparable with them, and thereby it is preferable to use a number of hydraulic accumulators connected in parallel as drive aggregate for extinguishing liquid.

Initially, the water pressure is so high that each spindle 8 of the spray heads 1 takes a position according to Figure 2, whereby liquid is sprayed out through all nozzles, extinguishing the fire. With the

hydraulic accumulators approaching discharge, the water pressure falls in the inlet 5 of the spray heads and the spray head 8 takes the position according to Figure 3. The rest of the water is sprayed out through each central nozzle 4 and has a function of cooling in the first place.

In Figures 4 and 5, the reference numeral 20 indicates a mouthpiece of the nozzle intended for spreading liquid in the form of fog-like drop formation. For this purpose, the liquid in a space 21 in front of an outlet 33 of the mouthpiece 20 must be subjected to strong whirling motion provided by means of a whirler 22 bearing against the body of the mouthpiece 20, the contact surface of which whirler against the inner conical surface of the mouthpiece 20 in the embodiment of Figure 4 is provided with at least one groove, suitably e.g. four preferably oblique grooves 23, for the liquid flowing in from a feed channel 7 via a disc filter 25, preferably a sintered metal filter, to an annular space between a nozzle socket 24 and the whirler 22, which groove 23 leads to the whirl chamber 21.

A nozzle seat of the housing 2 is provided with an annular shoulder 26, against which the sinter filter 25 bears thanks to the influence of the nozzle socket 24, which is fastened to the housing 2 by means of a threading 32 and presses the mouthpiece 20 against the whirler 22 and further via an elastic sealing, preferably in the form of an O ring 25 of a thickness of e.g. 1 mm, against the sinter filter 25 and the shoulder 26 of the housing 2.

For a satisfactory operation of the nozzle, close contact between the annular shoulder 26 of the housing 2 and the filter 25 as well as between an annular shoulder 30 of the sprinkler housing 2, the

shoulder bearing against a flange 31 of the socket 24, is required; the threading 32 is not tight.

A required sealing is achieved thanks to an elastic sealing means 28, which automatically compensates for deviations in tolerance as far as the shoulders 26 and 30 with respect to the filter 25 and the flange 31 are concerned, and in addition, keeps the whole joint tight and enables a relatively loose, i.e. untight installation of the filter 25 on a tap 34 of the whirler 22 at 29.

Under the influence of the pressure of the driving liquid, the whirler 22 can rotate alone, together with the O ring 28 and even bring along the filter 25, depending on mutual friction ratios.

In the alternative embodiment of Figure 5, the whirler is indicated by 40. Grooves 42 leading to the whirl chamber are not oblique, but on the other hand, the whirler 40 comprises a support flange, which is provided with e.g. four oblique grooves 41, by means of which the pressure of the driving liquid sets the whirler 40 in rotation. Between the support flange and the bottom of the nozzle seat is arranged an elastic sealing ring 43. The grooves 41 are deeper than the thickness of the sealing ring 43.

The whirler can also be brought into rotation in other ways within the scope of the enclosed claims.

The spray head can have four nozzles 3 directed obliquely downwards at an angle of about 45°. Especially when the individual nozzles are formed in accordance with the enclosed drawing, in which the nozzles take up relatively little space and can therefore be placed close to each other, it is possible to achieve concentration of the fog formation of the individual nozzles into a directional spray. The concentration

becomes stronger when the operating pressure increases; the fog sprays turn quickly towards each other and are accompanied thereafter. The concentration effect can be secured by means of a fifth nozzle 4 directed centrally straight downwards. Achieving the desired concentration of the fog spray depends on several parameters, primarily on individual spread angles and mutual main directions of the individual nozzles; a large individual spread angle facilitates contact with the fog screen of adjacent nozzles and thus the total concentration by means of suction from outside. The resulting fog flow pattern has a resemblance to a sponge with a relatively round head. The initial drop size of the nozzles 3 can preferably be about 60 µm, while the drop size of the central nozzle 4 can be about 80 µm.

Figure 6 shows schematically an embodiment of an installation especially intended for fire fighting in engine rooms of ships and other such spaces.

The reference numeral 50 of the figure indicates a liquid pump, the driving motor of which is indicated by 51. Three pressure governors, preferably adjusted to react at 50 bar, 180 bar and 200 bar, respectively, are indicated by 52, 53, 54, respectively.

The numeral 55 indicates five hydraulic accumulators connected in parallel, 50 litres each with a charging pressure of about 200 bar and a discharged pressure at rest of about 50 bar. Reference numerals 56, 57, 58 and 61 indicate valves, the lastmentioned of which is preferably manual. Two pneumatic accumulators with a charging pressure of e.g. 7 bar are indicated by 59 and 62, 60 indicates a line extending from the accumulator 59 to the control valves 57 and 58.

The numeral 63 indicates a fire zone, in which are placed a number of spray heads 1; the feeder from the hydraulic accumulators 55 to the fire zone 63 is indicated by 64, 65. A water pipe extending to the pump 50 is indicated by 66.

In the rest state of the equipment, the hydraulic accumulators 55 are charged up to 200 bar and the pump 50 and the motor 51 are each out of function. The valves 56 are closed, the pneumatic accumulators 59 and 62 are charged up to 7 bar and the valves 57 and 58 are currentless. The valves 61 are unactivated.

In case of a fire alarm, an electric signal is produced at the fire centre, which in a ship usually is situated on the bridge, to the valve 58, due to which the valve spindle is displaced and the valve leads pressure to a precontrol part of the valve 57, which part moves the spindle to the opposite end position. The valve 57 leads the pressure to the opposite area of a torsional cylinder of the valve 56 and the cylinder moves to the other end position. The valve 56, such as a ball valve, is now open and water flows to the spray heads 1.

After the pressure of the hydraulic accumulators 55 has fallen to 50 bar, the pressure governor 52 produces a signal to the valve 58, which becomes currentless and is moved to the basic position, and also the valve 57 is moved to the basic position and the valves 56 are closed. The pump 50 and the motor 51 have both received a starting signal at 180 bar from the pressure governor 53 and charge the hydraulic accumulators 55 up to 200 bar, after which the pump is stopped by the pressure governor 54. In the embodiment according to Figure 4, the pump 50 can have a volume flow of about 35 litres per minute and

the motor 51 a power of 15 kW. The charging time of the hydraulic accumulators 55 will be about 5 minutes, after which the equipment is ready to repeat the same procedure.

The manual valve 61 operates in the same way as the valve 58, except that water flows into the system as long as the valve 61 is kept activated. After the pressure has fallen, the valve shall be closed for a recharge of the accumulators 55.

The pneumatic accumulators 59 and 62 are kept charged by a compressed-air system.

In the embodiment shown in the drawing, in the individual spray heads the force of the spring 10 acting on the spindle 8 is fitted preferably in such a manner that the spindle 8 within the range of pressure of 200 bar to about 70 bar takes the position according to Figure 2 and within the range of pressure of about 70 bar to 50 bar takes the position according to Figure 3. Between 200 bar and 70 bar, a volume flow of typically 6,5 litres per minute on an average can be obtained, and between 70 bar and 50 bar, a flow of about 2 litres per minute.

By means of five hydraulic accumulators with a nominal volume of 50 litres each, an initial charging pressure of 50 bar and maximum working pressure of 200 bar, a water volume of about 190 litres is available.

An equipment like this provided with a suitable number of spray heads 1 can, without difficulties, meet a demand for water of about 120 litres in approximately 10 seconds within the pressure area of 200 to 70 bar, and after that, a demand for water of about 70 litres in approximately 25 seconds within the pressure area of 70 to 50 bar, thus in total 190 litres in 35 seconds.

Claims:

1. A fire fighting equipment, comprising at least one spray head with a number of nozzles preferably directed obliquely sideways, c h a r a c t e r i z e d in

that the nozzles are arranged to operate under high pressure for spraying fog-like extinguishing liquid and

that the nozzles (3) are arranged so close to each other that the fog formation areas of the individual nozzles intensify the fog flows and provide a suction for the concentration of the fog formation areas into a continuous directional fog spray.

2. A fire fighting equipment according to claim 1, c h a r a c t e r i z e d in that the nozzles (3) are arranged to spray extinguishing liquid with an initial drop size of about 60 µm.

3. A fire fighting equipment according to claim 1, c h a r a c t e r i z e d in

that the spray head (1) comprises a nozzle (4) positioned centrally with respect to said nozzles (3) directed obliquely sideways,

that a connecting channel (6) from the inlet (5) of the spray head (1) to the centrally positioned nozzle (4), from which channel (6) extend branchings (7) to the nozzles (3) directed obliquely sideways, comprises a spindle (8) having a connection (9) to the centrally positioned nozzle (4),

that the spindle (8) is arranged to be subjected to a force (10) tending to press the spindle (8), against the liquid pressure in the inlet (5) of the spray head (1), to close contact with the inlet (5), during which contact the connection between the inlet (5) and said nozzles (3) directed obliquely sideways

is closed, while the connection (9) via the spindle (8) to the centrally positioned nozzle (4) remains, and

that the driving liquid aggregate (26) of the spray head (1) has a reducable operating pressure so

that the operating pressure at a first stage overcomes the counterforce (10) of the spindle (8), extinguishing liquid being sprayed out through all nozzles (3, 4), and at a second stage is overcome by the counterforce (10) of the spindle (8), liquid being sprayed out only through the centrally positioned nozzle (4).

4. A fire fighting equipment according to claim 3, c h a r a c t e r i z e d in that the connection in the spindle (8) from the inlet (5) to the centrally positioned nozzle (4) comprises an axial boring (9).

5. A fire fighting equipment according to claim 3, c h a r a c t e r i z e d in that the counterforce acting on the spindle (8) is provided by means of a spring (10).

6. A fire fighting equipment according to claim 5, c h a r a c t e r i z e d in that the force of the spring (10) is adapted to correspond to a pressure of about 70 bar in the inlet (5) of the spray head (1).

7. A fire fighting equipment according to claim 3, c h a r a c t e r i z e d in that the driving liquid aggregate of the spray head (1) comprises a number of hydraulic accumulators (55) connected in parallel.

8. A fire fighting equipment according to claim 7, c h a r a c t e r i z e d in that the hydraulic accumulators (55) have a working charging pressure of about 200 bar and a discharged pressure at rest of

about 50 bar.

9. A fire fighting equipment, especially for fire fighting in engine rooms of ships and like spaces, by utilizing a fire fighting equipment of claim 3, c h a r a c t e r i z e d in

that a liquid pump (50) with a high operating pressure and with a volume capacity considerably lower than the amount of liquid required for extinguishing is arranged to charge a number of hydraulic accumulators (55) connected in parallel in the rest state of the equipment,

that these hydraulic accumulators (55) are arranged to deliver extinguishing liquid to a seat of fire discovered, and

that the main line (65) extending to the seat of fire is arranged to be closed after the hydraulic accumulators (55) have been emptied, for a recharge of these accumulators and, if necessary, for a new delivery of extinguishing water.

10. A fire fighting equipment according to claim 1, c h a r a c t e r i z e d in that each nozzle (3) comprises a nozzle socket (24) fastened inside a housing (2) of the spray head, in which socket is positioned a mouthpiece (20) and a whirler (22) arranged to bear against it, which whirler together with the mouthpiece (20) defines a whirl chamber (2), and that the whirler (22) is supported in the housing (2) in such a manner that the whirler is set in rotation by the liquid pressure.

11. A fire fighting equipment according to claim 10, c h a r a c t e r i z e d in that the contact surface of the whirler (22) against the mouthpiece (20) comprises at least one oblique groove (23) for leading liquid to the whirl chamber (21).

12. A fire fighting equipment according to

claim 10 or 11, c h a r a c t e r i z e d in that the whirler (22) is supported in the sprinkler housing (2) via a filter (25) and an elastic sealing means (28) positioned between the whirler (22) and the filter (25).

13. A fire fighting equipment according to claim 12, c h a r a c t e r i z e d in that the elastic sealing means is an O ring (28) positioned around a tap (34) provided on the whirler (22).

14. A fire fighting equipment according to claim 12, c h a r a c t e r i z e d in that the filter (25) comprises a metallic, preferably sintered disc filter positioned around a tap (34) provided on the whirler (29).

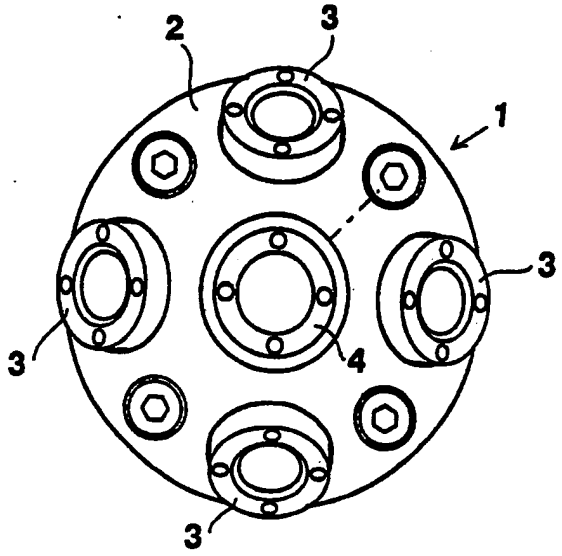

FIG. 1

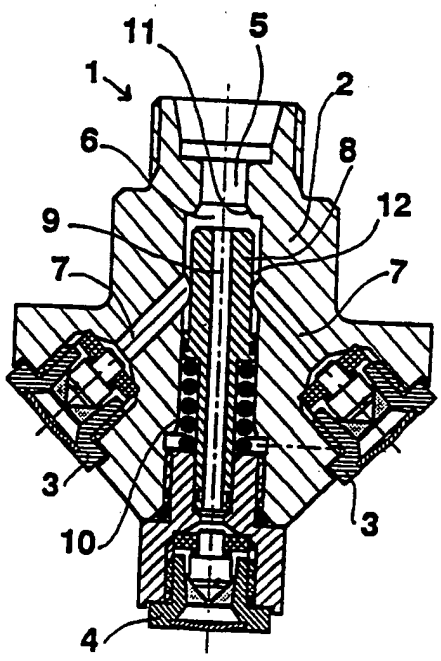

FIG. 2

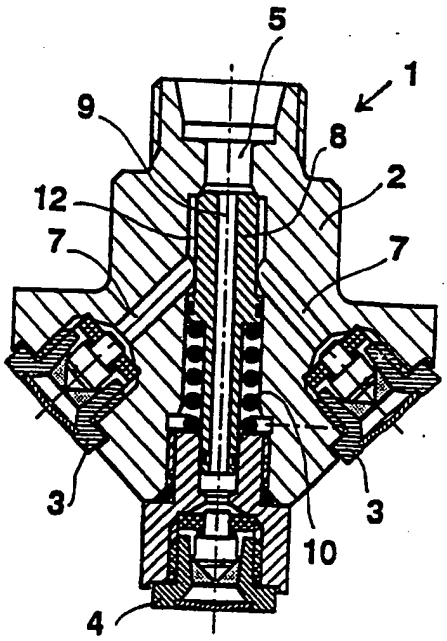

FIG. 3

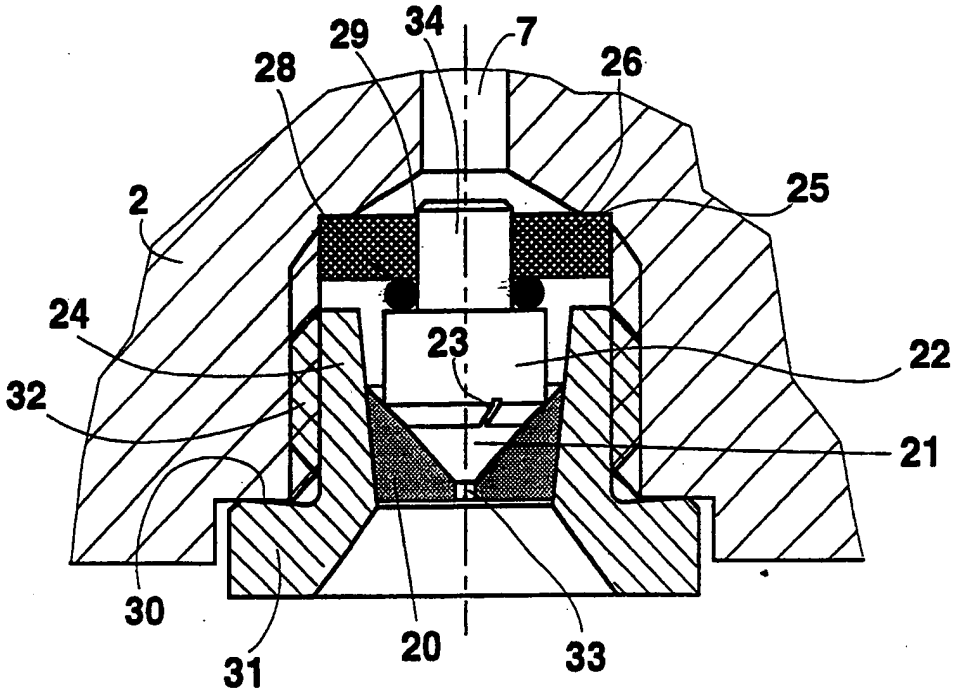

FIG. 4

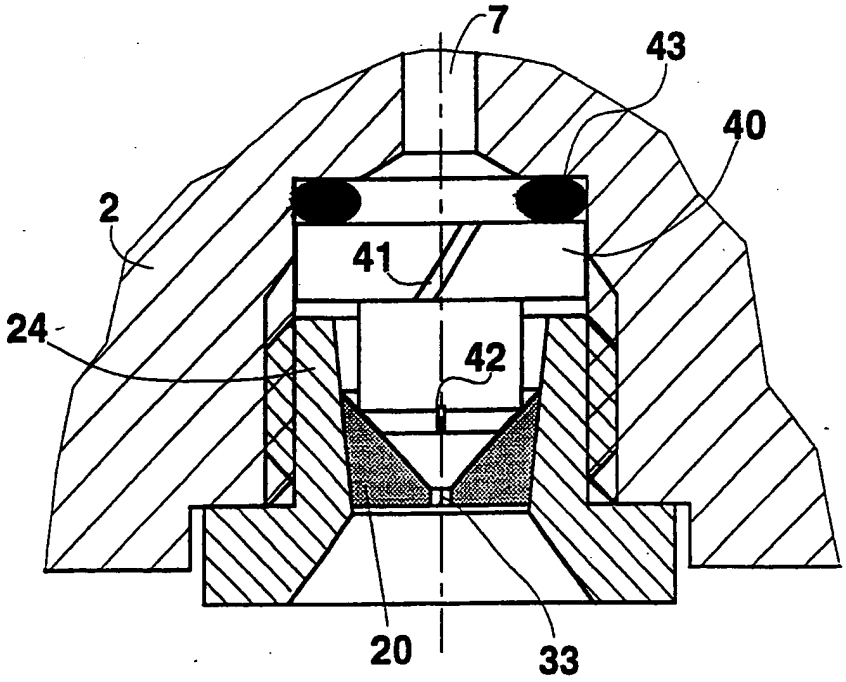

FIG. 5

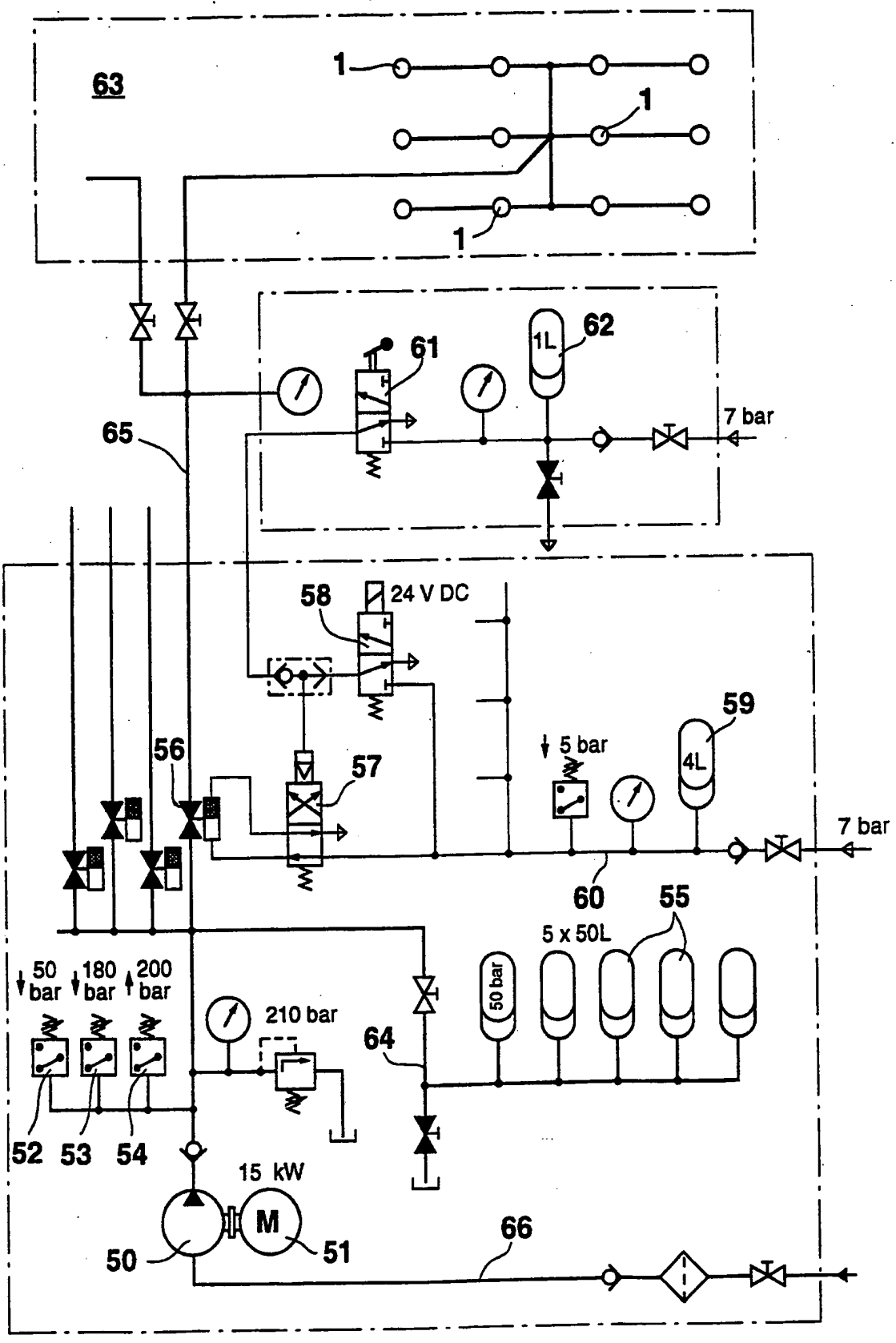
63
1
1
1
61
62
1L
7 bar
65
58
24 V DC
59
4L
5 bar
56
57
7 bar
60
55
5 x 50L
50 bar
50 bar
180 bar
200 bar
210 bar
64
52
53
54
15 kW
M
50
51
66

FIG.6

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00155

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 05 B 1/34, A 62 C 31/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 60 B; A 62 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	DE, A1, 3440901 (VEB METALLEICHTBAUKOMBINAT) 11 July 1985, see the whole document	1,2
Y	--	10,11, 12,13, 14
Y	GB, A, 2076696 (DELAVAN CORPORATION) 9 December 1981, see the whole document	10,11, 12,13, 14
A	-- CH, A, 435990 (J & R. GUNZENHAUSER AG) 15 November 1967, see figures 2,3	3,4,5
A	-- US, A, 3684194 (WAYNE) 15 August 1972, see the whole document	10-14
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
3rd September 1992	1992 -09- 07
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Ulrika Öhman

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	WO, A1, 8905195 (DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FÜR LUFT- UND RAUMFAHRT E.V.) 15 June 1989, see the whole document --	10-14

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00155

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 31/07/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A1- 3440901	85-07-11	NONE		
GB-A- 2076696	81-12-09	BE-A-	889019	81-09-16
		CA-A-	1153905	83-09-20
		CH-A-B-	655252	86-04-15
		DE-A-	3119346	82-04-15
		FR-A-B-	2483261	81-12-04
		JP-A-	57020612	82-02-03
		NL-A-	8102433	81-12-16
		US-A-	4360156	82-11-23
CH-A- 435990	67-11-15	NONE		
US-A- 3684194	72-08-15	NONE		
WO-A1- 8905195	89-06-15	EP-A-	0346417	89-12-20
		US-A-	5067655	91-11-26